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(54) **MULTI-AXIS LOAD GRIPPING ARM**

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***B66F 9/18*** (2006.01)

(52) **U.S. Cl.**
CPC ..... ***B66F 9/183*** (2013.01); ***B66F 9/188*** (2013.01)

(58) **Field of Classification Search**
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USPC ..... 414/621, 623, 618, 785, 931, 664, 665, 414/670, 620; 294/62, 63.1, 63.2; 901/45
See application file for complete search history.

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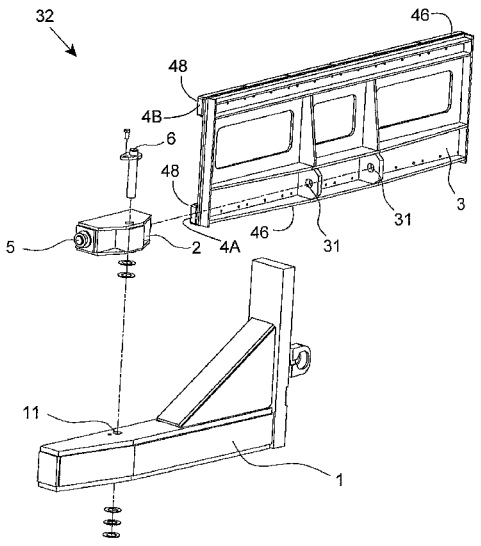
(57) **ABSTRACT**

A gripping arm for a clamping attachment for a forklift has a load engaging inner arm including portions defining a load face. The inner arm is pivotal about a first axis parallel to the load face and pivots about a second axis normal to the first axis to engage and secure a load.

**17 Claims, 5 Drawing Sheets**



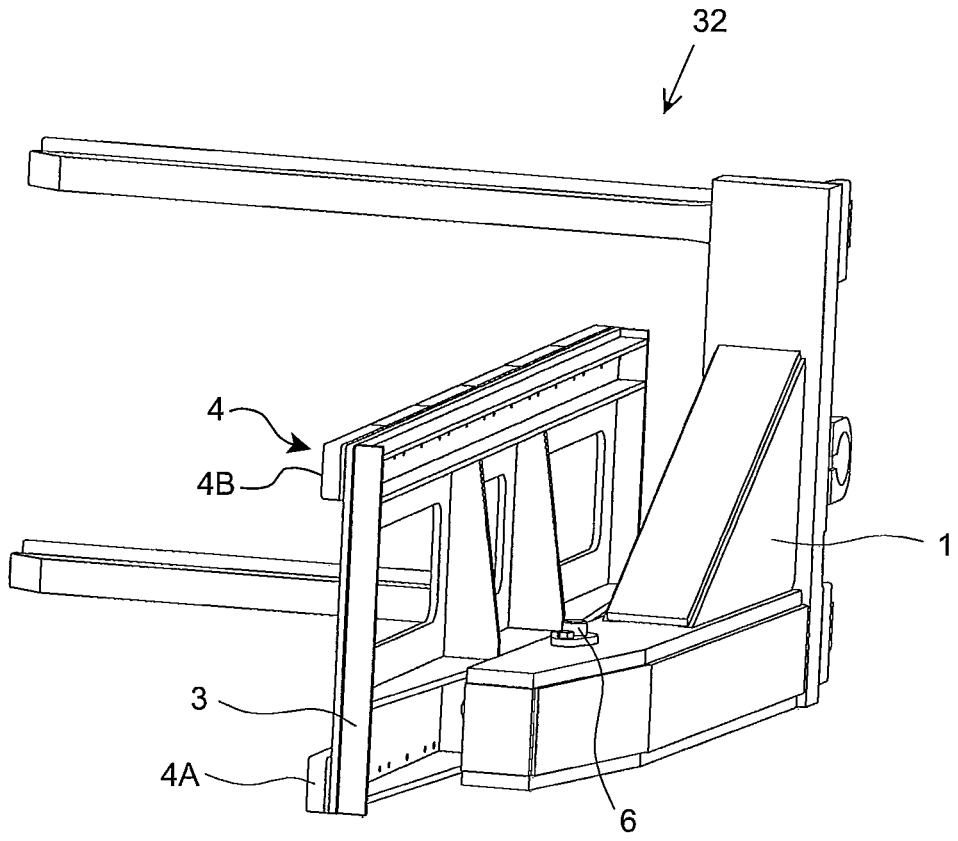



FIG. 1

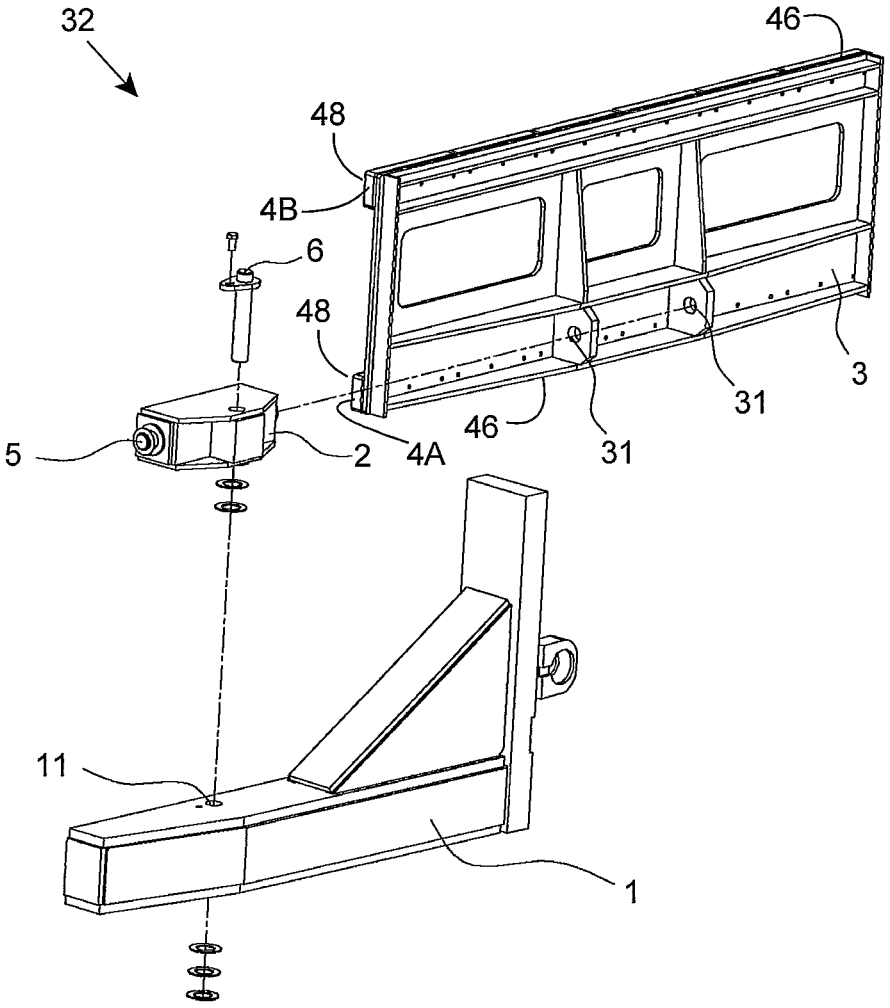



FIG. 2

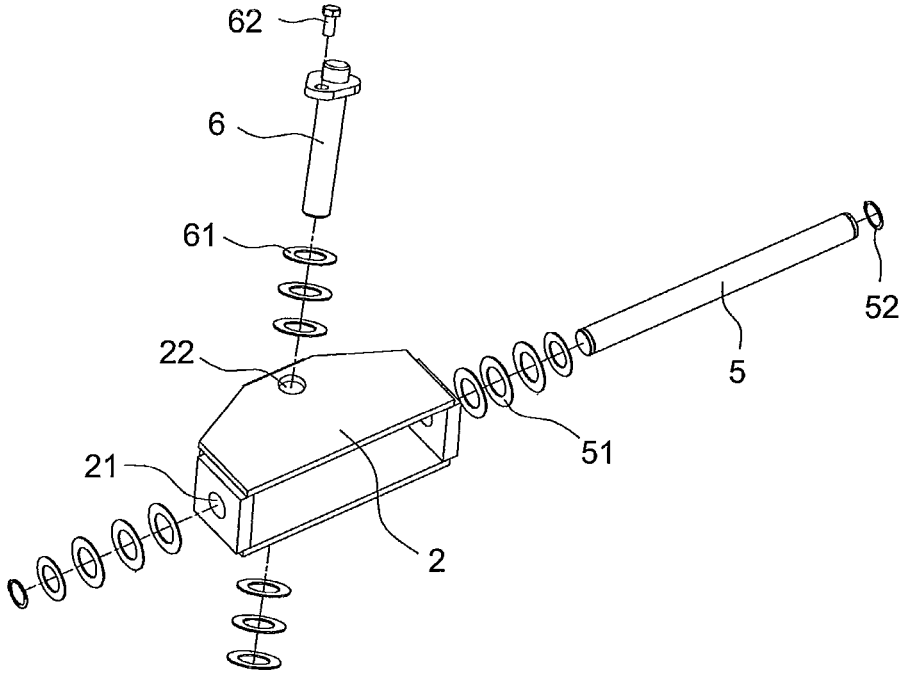



FIG. 3

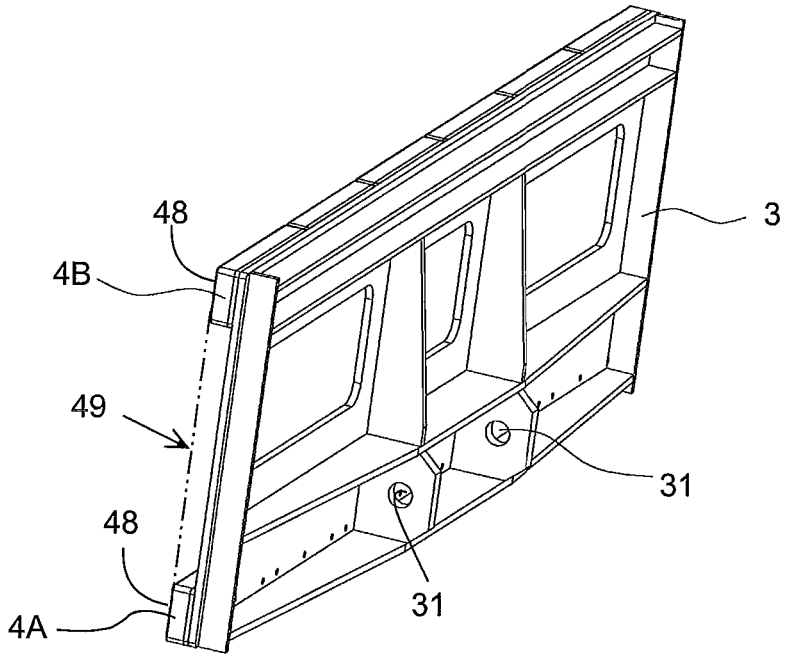



FIG. 4

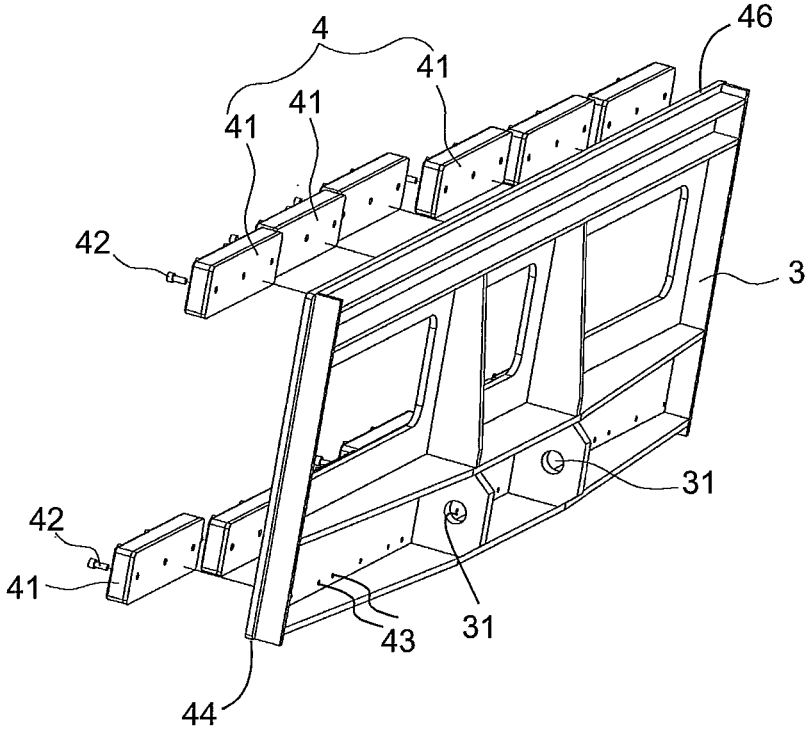



FIG. 5

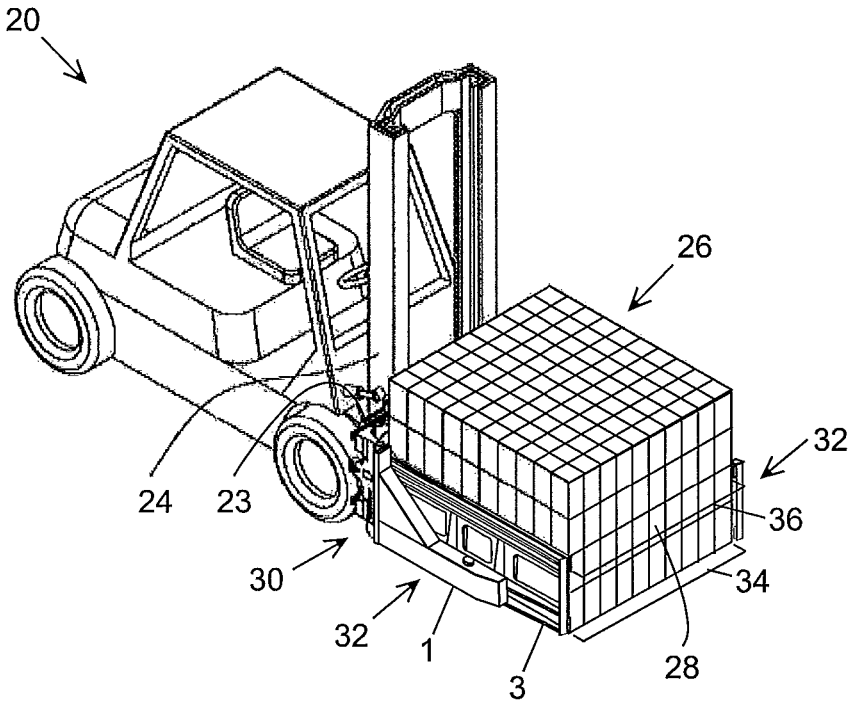



FIG. 6

# MULTI-AXIS LOAD GRIPPING ARM

## TECHNICAL FIELD

The present disclosure relates to an attachment for a forklift truck, and in particular relates to a gripping arm for a load clamping attachment mountable on a forklift.

## BACKGROUND ART

Forklift truck attachments comprise a variety of devices and tools for realizing multiple functions from a single forklift. Convenient installation and removal of different working attachments allows a forklift to adapt to a variety of conditions. Forklift attachments enhance the work efficiency and safety performance of the forklift, and are also an important means of significantly reducing damage to the loads being handled. For example, the use of a paper roll clamp to move paper rolls can minimize or avoid damage to paper rolls; if using a forklift not equipped with a paper roll clamp, the incidence of damage to paper rolls can increase by 15%. For packaging enterprises which use large quantities of paper or use high quality paper, the investment in such an attachment will be recovered in just a short period of time, and the subsequent avoidance of the 15% damage rate can greatly lower the production costs of the enterprise. The use of a fork positioner enables the driver to adjust the fork-to-fork distance as required from the seat via a control lever, thus improving work efficiency, reducing labor, and avoiding damage to the pallet and finger injuries during adjustment. The use of push/pulls for transporting materials with an inexpensive slip sheet instead of a pallet and saves on pallet maintenance and stacking-related expenses. Particularly when stacking loads inside containers and rail cars, stacking space is more efficiently conserved. It may be seen that forklift attachments play an important role in fully utilizing the functions of the forklift truck.

Clamps are a type of forklift attachment that can safely and efficiently clamp various stone and brick materials, and are suited to palletless moving and stacking operations in the floor tile, concrete preform, masonry and graphite, etc. industries. They are typically composed of a rear mounting system, a left gripping arm, a right gripping arm and a hydraulic system. The rear mounting system connects the entire attachment to the forklift. The left and right arms are equipped with rubber blocks. The hydraulic system functions to generate frictional force when the left and right arms clamp a load, balancing the gravitational force of the load, so as to achieve the function of transporting the same.

The structure of current gripping arms is typically constituted by an outer arm, an inner arm and a pin. The inner arm is equipped with a single rubber block, while the pin, gaskets and outer arm together form a horizontal hinge structure which is further provided with limiting members at both ends. In practice, the horizontal adjustment range is limited, and there is no mechanism allowing adjustment in the vertical direction, such that loads cannot be evenly borne, and are prone to sliding off and sustaining damage. In addition, the use of a single rubber block imposes height restrictions, and tall loads are unable to be effectively stabilized, while repairs and maintenance are difficult once the entire block becomes worn. What is desired, therefore, is clamp attachment mountable on a forklift which provides improved load stability and reduces the cost and difficulty of maintaining the gripping arms.

## SUMMARY OF THE DISCLOSURE

To provide a load gripping arm for a forklift truck which evenly distributes load stress and affords steady and reliable clamping, the present gripping arm comprises an outer arm, a balance arm, an inner arm, and a rubber block. The rubber block is mounted on the inner surface of the inner arm. Mounting holes for the inner arm are disposed along the horizontal direction of the outer surface of the inner arm. A horizontal through-hole is provided along the horizontal direction of the balance arm, and on one side of the horizontal through-hole is provided a vertical through-hole. The balance arm can be mounted to swing vertically on the inner arm mounting holes by means of a horizontal pin passing through the balance arm horizontal through-hole, and the balance arm can be mounted to swing horizontally on a vertical through-hole of the outer arm by means of a vertical pin passing through the vertical through-hole of the balance arm.

The rubber block is composed of a plurality of small rubber blocks, which are fixed on the inner surface of the inner arm by means of bolts.

After adopting the foregoing solution, the gripping arm is primarily composed of the outer arm, a balance arm, and an inner arm. The addition of such a balance arm enables the gripping arm to possess the following advantages relative to conventional gripping arms:

1. Owing to the addition of a balance arm in the present utility model, the balance arm can swing horizontally with respect to the outer arm, and swing vertically with respect to the inner arm, thereby enabling vertical adjustment, improving the structure of the gripping arm, and expanding the range of adjustment in the horizontal direction. An automatic bidirectional adjustment effect is thus achieved, allowing for balanced bearing of a load, and preventing portions of the same from sliding off and sustaining damage.

2. The rubber block in the present gripping arm is composed of a plurality of small rubber blocks, which are bolted to the inner arm. Firstly, this enables clamping of smaller brick-like materials, expanding the scope of use of the attachment. Secondly, once the rubber block begins to wear, it can be partially replaced without needing to replace the entire block as required previously, thus reducing customer maintenance costs. Thirdly, securing the blocks with a bolt renders assembly and disassembly more convenient, significantly shortening the time spent on attachment repairs and maintenance.

3. The adoption of a double-layer or multi-layer rubber block for the present gripping arm can ameliorate the stress between the attachment and the load, while also enabling effective stabilization for tall loads and preventing loads sliding off the upper layer during accidental collisions, making material handling safer.

4. The structure of the gripping arm according to the present utility model enhances adjustment performance in the horizontal direction without compromising structural strength and rigidity. At the same time, the balance arm hinge enhances the ability of the attachment to automatically adjust in the vertical direction. In addition, the middle of the gripping arm is grooved, which in one aspect can reduce the weight of the attachment, improving its carrying capacity, and in another aspect can increase the field of view of the operator, which is advantageous to operational reliability.

What follows incorporates the accompanying drawings and specific embodiments to further illustrate the novel present gripping arm.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an axonometric view of a gripping arm for a clamping attachment mountable on a forklift.

FIG. **2** is a three-dimensional exploded view of the gripping arm of FIG. **1**.

FIG. **3** is a three-dimensional exploded view of the balance arm of the gripping arm of FIG. **1**.

FIG. **4** is an axonometric view of the inner arm of the gripping arm of FIG. **1**.

FIG. **5** is a schematic view of the assembly of the inner arm and rubber blocks of FIG. **4**.

FIG. **6** is a perspective view of a forklift truck equipped with a clamping attachment which includes the gripping arm of FIG. **1**.

## DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

Referring to FIG. **6**, a forklift truck **20** (also called a lift truck, a fork truck, or a forklift) is a powered industrial truck used to lift and transport materials. A load to be lifted and transported is engaged and supported by a load engaging device which is typically attached to a rear mounting system or carriage **23** arranged to be raised, lowered and tilted in a mast **24**. A basic load engaging device for a forklift is a pair of forks or load arms each comprising a vertical bar or shank attachable to the carriage and a horizontal shank projecting normal to the vertical shank to engage the lower surface of a load. However, many forklifts are equipped, or can be equipped, with one or more attachments to facilitate efficient handling of certain loads. For example, if a load is to be supported by the forks of a forklift the lower surface of the load must be unitary but composite loads, such as the exemplary load **26**, comprising a plurality of smaller objects **28**, such bricks or concrete blocks, do not have unitary lower surfaces that can support the load when engaged by the narrow horizontal shanks of a pair of forks. If a composite load is to be handled with forks, it is typically placed on a pallet to provide a unitary lower surface for supporting the load, but this increases the cost of load handling and the pallet can consume valuable storage space. The forklift **20** is equipped with a clamping attachment **30** which is attached to the carriage **23**, or which includes an integral carriage, and which is arranged to move a pair of load gripping arms **32** toward each other, to clamp a load or a portion of a load therebetween. By increasing friction between the objects making up a composite load and, more particularly, the objects making up a bottom layer of a composite load, for example, the bottom layer **34** (indicated by a bracket) of the exemplary composite load **26**, the load clamping attachment unitizes the bottom surface of the load enabling the composite load to be lifted and transported without a pallet or other secondary support means. As shown in FIGS. **1** and **2**, each gripping arm **32** of the clamping attachment **30** comprises an outer arm **1** including a portion projecting from the forklift in the direction of the load to be engaged, a balance arm **2**, an inner arm **3**, a rubber block **4**, a horizontal pin **5**, and a vertical pin **6**.

As shown in FIGS. **4** and **5**, the elongate rubber block **4** comprises a plurality of small rubber blocks **41**, the small rubber blocks **41** being fixed to the inner surface **40** of the inner arm **3** by means of a bolt **42**. Preferably, mounting holes **43** are provided proximate the opposing upper **46** and lower **44** edges of the inner arm **3** enabling attachment of a plurality of small rubber blocks **41** to form an elongate rubber block **4**A proximate the lower edge of the inner arm and an elongate rubber block **4**B distal of the lower edge and, more preferably, proximate the upper edge of the inner arm. The surfaces **48**, distal of the inner surface **40** of the inner arm **3** to which the rubber blocks **4**A and **4**B are mounted, preferably define a plane **49** and comprise the load face of the gripping arm, the portions of the gripping arm that engage the load being clamped. Mounting holes **31** for mounting the inner arm are provided along the horizontal direction of the outer surface of the inner arm **3**.

As shown in FIG. **3**, a horizontal through-hole **21** is provided along the horizontal direction of the balance arm **2**, and, along the vertical direction on one side of the horizontal through-hole **21**, is provided a vertical through-hole **22**. The balance arm **2** can be mounted to swing vertically, that is, on an axis substantially parallel to the load face(s) **48** defined by the rubber blocks **4**A and **4**B, on the inner arm **3** mounting holes **31** by means of a horizontal pin **5** passing through the balance arm horizontal through-hole **21** (as shown in FIG. **2**), and secured with gaskets **51** and retaining ring **52**. The balance arm **2** can be mounted to swing horizontally, that is, on an axis normal to the axis of the horizontal pin **5**, on a vertical through-hole **11** of the outer arm **1** by means of a vertical pin **6** passing through the balance arm vertical through-hole **22** (as shown in FIG. **2**), and secured with gaskets **61** and a bolt **62**.

As FIG. **2** shows, once assembly is complete, the inner arm **3** and the balance arm **2** can rotate in the vertical direction, that is, the inner arm can pivot on a first axis parallel to the longitudinal axis of the load face **48** of the rubber block **4**A, about horizontal pin **5** while the inner arm **3** and the balance arm **2** can rotate in the horizontal direction, that is the inner arm **3** can pivot on a second axis substantially normal to the first axis and generally parallel to the plane **49** defined by the load faces **48** of the lower rubber block **4**A and the upper rubber block **4**B, about the vertical pin **6**. As a load is clamped, automatic bidirectional adjustment can be achieved, ensuring the load stress is evenly borne. Furthermore, the vertical rotation, that is, rotation of the inner arm **3** about the horizontal pin **5**, can act to provide effective contact between the upper rubber block **4**B and a second layer of the load, for example the layer **36** (indicated by a bracket) of load **26**, improving the load bearing performance of the attachment.

The focus of the present disclosure lies in the addition of a balance arm permitting the inner arm of the gripping arm to adjust on multiple axes.

The foregoing is merely a preferred embodiment of the gripping arm; the assembly of the balance arm may take a variety of forms, such that the scope of the present disclosure is not restricted thereto. Equivalent changes and embellishments made according to the Claims and Description of the present disclosure still fall under the scope of the disclosure.

What is claimed is:

**1**. A gripping clamp for a forklift truck, the clamp comprising:

(a) a first gripping arm including a first elongate block arranged to engage an elongate lower portion of a load, a longitudinal axis of said first block approximately parallel to a bottom surface of said load, and a second elongate block spaced apart from said first block in a direction normal to said longitudinal axis of said first block and arranged to engage a second elongate portion of said load more distant from said bottom surface of said load than any part of said lower portion, said first block and said second block fixedly defining a plane and arranged to pivot about said longitudinal axis of said first block and to pivot about a second axis substantially

normal to said longitudinal axis of said first block and parallel to said plane defined by said first block and said second block; and

(b) a second gripping arm including a third elongate block arranged to engage an elongate second lower portion of said load, a longitudinal axis of said third block approximately parallel to said bottom surface of said load, and a fourth elongate block spaced apart from said third block in a direction normal to a longitudinal axis of said third block and arranged to engage another elongate portion of said load more distant from said bottom surface of said load than any part of said second lower portion, said third block and said fourth block fixedly defining a plane and arranged to pivot about said longitudinal axis of said third block and to pivot about an axis substantially normal to said longitudinal axis of said third block and parallel to said plane defined by said third block and said fourth block; wherein said first gripping arm and said second gripping arm are movable together to clamp a load between said elongate blocks.

**2**. The clamp of claim **1** wherein at least one of said first block, said second block, said third block and said fourth block comprises a plurality of rubber blocks fixed on a surface of an arm by means of a bolt.

**3**. A load gripping arm for a forklift mountable clamping attachment, the load gripping arm comprising an inner arm having an elongate first load face portion movable to engage a lower portion of a load proximate a bottom surface of the load and a second load face portion spaced apart in a direction normal to a longitudinal axis of the first load face portion and fixedly arranged substantially coplanar with the first load face portion, the second load face portion engageable only with portions of the load more distal of the bottom surface of the load than any portion of the load engageable by the first load face portion, the inner arm arranged to pivot about a first axis parallel to the longitudinal axis of the first load face portion and arranged to pivot about an axis normal to the first axis and generally parallel to the plane of the first load face portion and the second load face portion.

**4**. The load gripping arm of claim **3** wherein at least one of the first load face portion and the second load face portion comprises a surface of a block attached to the inner arm.

**5**. The load gripping arm of claim **4** wherein the block comprises rubber.

**6**. The load gripping arm of claim **4** wherein the block comprises a plurality of blocks respectively attached to the inner arm.

**7**. The load gripping arm of claim **3** further comprising:

(a) an outer arm movably securable to a forklift; and

(b) a balance arm secured to the inner arm and arranged to pivot relative to the inner arm about the first axis extending substantially parallel to said first load face portion and secured to the outer arm and arranged to pivot relative to the outer arm about the second axis extending substantially normal to the first axis.

**8**. The load gripping arm of claim **3** further comprising:

(a) an outer arm movably securable to a forklift; and

(b) a balance arm pivotally secured to the inner arm by first pin having a longitudinal axis extending substantially parallel to the first load face portion and pivotally secured to the outer arm by a second pin having a longitudinal axis normal the longitudinal axis of the first pin.

**9**. A load gripping clamp for a forklift truck, the clamp comprising:

(a) a first load gripping arm; and

(b) a second load gripping arm movable toward the first load gripping arm to clamp a load therebetween, the first load gripping arm and the second load gripping arm each comprising:

(i) an elongate first load face portion arranged to engage a lower portion of a load proximate a bottom surface of the load to be clamped; and

(ii) an elongate second load face portion fixedly arranged substantially coplanar with and spaced apart from the first load face portion in a direction normal to a longitudinal axis of the first load face portion to engage another portion of the load to be clamped, all of said other portion of said load more distant from the bottom surface of the load than any part of the lower portion engageable by the first load face portion, the first load face portion arranged to pivot about a first axis approximately normal to the longitudinal axis of the first load face portion and substantially parallel to the plane defined by the first load face portion and the second load face portion and to pivot about a second axis substantially coincident to the longitudinal axis of the first load face portion.

**10**. The load gripping clamp of claim **9** wherein the first load face portion and the second load face portion of each of the first gripping arm and the second gripping arm comprise surfaces of plural elongate blocks affixed to, respectively, a first inner arm and a second inner arm.

**11**. The load gripping clamp of claim **10** wherein at least one of the plural elongate blocks comprises rubber.

**12**. The load gripping clamp of claim **10** wherein at least one of the plural blocks comprises a plurality of block portions each respectively attachable to one of the first inner arm and the second inner arm.

**13**. The load gripping clamp of claim **9** wherein the first load gripping arm and the second load gripping arm each further comprise:

(a) an outer arm movably securable to a forklift and including an elongate first portion extending from the forklift in a direction of a load to be clamped by the load gripping clamp;

(b) a balance arm secured to the outer arm and arranged to pivot relative to thereto about the first axis extending substantially normal to a longitudinal axis of the first portion of the outer arm; and

(c) an inner arm secured to the first load face portion, the second load face portion and the balance arm and arranged to pivot relative to the balance arm about the second axis extending substantially parallel to the first load face portion.

**14**. The load gripping clamp of claim **13** wherein the first load face portion and the second load face portion secured to the first inner arm each comprise surfaces of plural elongate blocks.

**15**. The load gripping clamp of claim **14** wherein at least one of the plural elongate blocks comprises rubber.

**16**. The load gripping clamp of claim **14** wherein at least one of the plural blocks comprises a plurality of block portions each respectively attachable to the inner arm.

**17**. The load gripping clamp of claim **16** wherein at least one of the plural block portions comprises rubber.

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